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AUTHOR Winston, Barbara J.
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ABSTRACT

This publication is intended for those who wish to design or evaluate a map and globe skills program across several grade levels. The introduction discusses general considerations underlying effective map and globe skills instruction. A grade-by-grade outline of a map and globe skills program provides recommendations for the following categories: using symbols, finding location, orienting and using directions, using scale and finding distance, and selecting media (i.e., comparing advantages and disadvantages of different kinds of media, including maps or globes, for communicating different kinds of information). For each category, learning suggestions are made for developing supportive concepts and skills. For example, at the kindergarten level, under the category of "Using Symbols," one of the skills that children should be taught is that of reporting information. The children might do this by constructing a three-dimensional model on the floor of the classroom using blocks, toy cars, and trucks to model a familiar scene. The guide concludes with a five-page reference list. (RM)

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TOPICS IN GEOGRAPHY, NO. 7

# MAP AND GLOBE SKILLS: K-8 TEACHING GUIDE

COMPLIMENTARY COPY

BARBARA J. WINSTON

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## INTRODUCTION

We live in an age when a great amount of information is mediated in some manner. American schools, which always devoted attention to skills development, are intensifying efforts to develop learners' abilities to use many different types of media. Recent attention is aimed at skills related to computerized retrieval systems, and in a growing number of cases, students learn to use satellite photos as sources of information. These newer efforts take place along with more traditional skills development in social studies and other curriculum areas. If it seems that educators everywhere are concerned about basic skills which enhance students' abilities to select information sources intelligently and use them productively, it is because these skills support other learning and build competencies required for adult citizenship.

All information sources are designed to serve particular purposes. There are occasions when graphs are better than tables to communicate statistical information. There are also times when a bar graph is more appropriate than a line or circle graph to report data. We appreciate pictures or diagrams worth thousands of words, and also marvel at ways literary treatments use words to communicate ideas in a manner unsurpassed by any other medium. Like other sources of information, maps and globes serve particular purposes. On those occasions when information we seek involves spatial relationships and answers basic questions such as "Where?" "In what direction?" or "How far?" then a map or globe will be useful.

As students of geography apply these basic questions to complex studies of earth's physical environment, relationships between humans and the natural environment, regional studies, and spatial patterns and processes, map and globe use is necessary to grasp related concepts and principles. Additionally, maps are vital to study geographic aspects of other subject areas such as:

1. government and politics - to understand voting patterns, investigate sizes, shapes and relationships among national territories, evaluate legislative apportionment issues, map a political campaign to influence public opinion, evaluate a community conflict over a land use issue;
2. history - to trace routes of explorers, study world territories claimed by Europeans, investigate historic boundary claims and the westward spread of settlement, examine changes in an area's land use over time;
3. economics - to analyze local or global trade patterns, investigate service areas of retail stores or newspaper circulation, compute cost/distance factors involved in shipping goods, compare property values, select the best site for a shopping center;
4. population studies - to compare demographic data for several countries, analyze problems associated with population density and distribution, propose solutions to deal with worldwide nutrition problems, describe and evaluate the impact of population growth patterns in a metropolitan area.
5. urban studies - to make location decisions for public facilities, compare land use patterns in world cities, evaluate consequences or urban growth on agricultural lands, investigate neighborhood crime rates or unemployment data;
6. culture and societies - to trace the origin and spread of an invention, compare and evaluate reasons senior citizens prefer selected retirement areas, study the distribution of world religions or language groups, map one's global connections based on ancestry, products used, or shared beliefs;
7. environmental studies - to analyze the causes and effects of pollution patterns, investigate limited factors in the distribution of natural vegetation or wildlife, compare factors that lead to water quality problems, analyze energy production and consumption data.

In all these cases and countless others, the geographic component of issues or processes will be grasped by students who develop basic skills to use maps with understanding.

Our students are preparing for citizenship at a time in human history when they need abilities and perspectives developed through map use. Among these are abilities to conceive of the natural environment as a single, integrated global system, to understand one's self as a consumer of natural resources from geographically different parts of the world, and to understand that activities of all humans affect the earth's biosphere. Additionally, citizenship will involve the capacity to perceive ways in which individuals and groups are linked to the world's socio-cultural system, and the understanding that people everywhere may have different perspectives about this system, its components and its relationships. Global interrelatedness and the ramifications which arise from this reality lead to growing interest in appropriate educational responses. The maps we give children and the learning strategies we use can help to provide appropriate responses.

It is hoped that curriculum developers who devote time and thought to map and global skills instruction will appreciate the need to use maps which show global interconnectedness, graphically display commonalities and diversity in the planet's natural and socio-cultural systems, and present the world from the perspectives of people in other hemispheres. Many of the strategies presented in the Guide are flavored with activities based on these needs. Those who

produce maps, design computerized map instruction programs, or simply use maps to teach might consider these ideas along with others presented.

This paper is devoted to those who wish to design or evaluate a map and globe skills program across several grade levels. The paper reflects some long-standing ideas about children's abilities and some new ideas about sequencing and developing instructional strategies. It offers a discussion of general considerations underlying effective map and globe skills instruction followed by a grade level outline of a systematic program to use or adapt in K-8 map and globe skills development. Illustrative examples of learning strategies are supplied. These are not intended to be exhaustive, but rather to act as stimuli for curriculum developers to add their own creative ideas. This cooperative process will make the Guide more useful to school committees and individual teachers who know their students better than anyone, and will add to the quantity of practice-related experiences needed to insure skilled behaviors.

## GENERAL CONSIDERATIONS

There seem to be five very basic considerations underlying a sound map and globe skills program.

1. Programs that effectively teach skills related to maps and globes promote knowledge of and appreciation for the utility of these media for particular purposes.
2. Effective use of maps and globes depends on specialized skills in acquiring and reporting information.
3. Effective use of maps and globes depends on supportive concept development.
4. Effective use of maps and globes depends on abilities to use information-processing or thinking skills.
5. The sequence of activities in an effective map and globe skills program incorporates developmental considerations and opportunities to apply and refine concepts and skills.

A numerical listing implies priority and separateness that do not reflect the reality. We do not develop a complete inventory of concepts during one stage of learning and then move on to special skills or thinking processes at another. Figure 1 illustrates more accurately how each consideration works with all the others in map and globe skills instruction.

Each of these considerations will be discussed in turn. This allows detailed treatment as well as ideas for implementation. Further, separate treatment implies that no consideration should be overlooked and each must receive full attention for the system to lead to students' skilled behaviors in using maps and globes.

1. Programs that effectively teach skills related to maps and globes promote understanding and appreciation of the utility of these media for particular purposes.

An anecdote serves as a useful introduction here. On several occasions in a freshman college geography class, the professor described requirements for the course. One required project included a detailed, comparative analysis of three regions in the world incorporating data on climate, natural vegetation, landforms, natural resources, economic activities, degree of urbanization, literacy, income levels, population density and distribution, population growth rates, variables related to health factors, import/export data and overall inferences about the degree of modernization in the regions. The professor heard groans and observed dirty looks and then instructed class members to work in small groups to identify sources they might check to seek the information needed.

After a short time, each group reported consensus about the best potential sources for the data. Ideas included texts and other specialized books on each region or countries in the regions, several popular news magazines, statistical yearbooks, almanacs, and encyclopedias. Over the years, as this experience was repeated, only a few groups suggested maps as potential sources for needed information (even though most students had purchased and brought to class the required atlas with its comprehensive collection of maps containing all the information needed for the project). Later, a guided overview of these maps brought sounds of relief and expressions of discover from the students.

While several hypotheses could be explored to explain the anecdote, it seems clear that (a) students did not know about relevant specialized maps, and (b) students' ready inventories of data sources did not include maps as media for potentially useful information.

Perhaps these ideas are worrisome only to geographers, or librarians, or teachers generally, especially since the anecdote describes an academic exercise one might not confront outside of a university classroom. On the other hand, those who respect the utility of maps might worry about adults in everyday life who overlook these media as valuable tools to comprehend world problems, evaluate alternative viewpoints on land use issues or decide on an appropriate location for a place to live.

The facts are, if we want children to become fully-functioning adults who seek and process information from the range of media available, including maps and globes, the following must occur across the grade levels:

(1) Students must have frequent opportunities to use these media in the context of other learning. Since social studies provides valuable learning in general, as well as abundant opportunities to use maps and globes, all possible

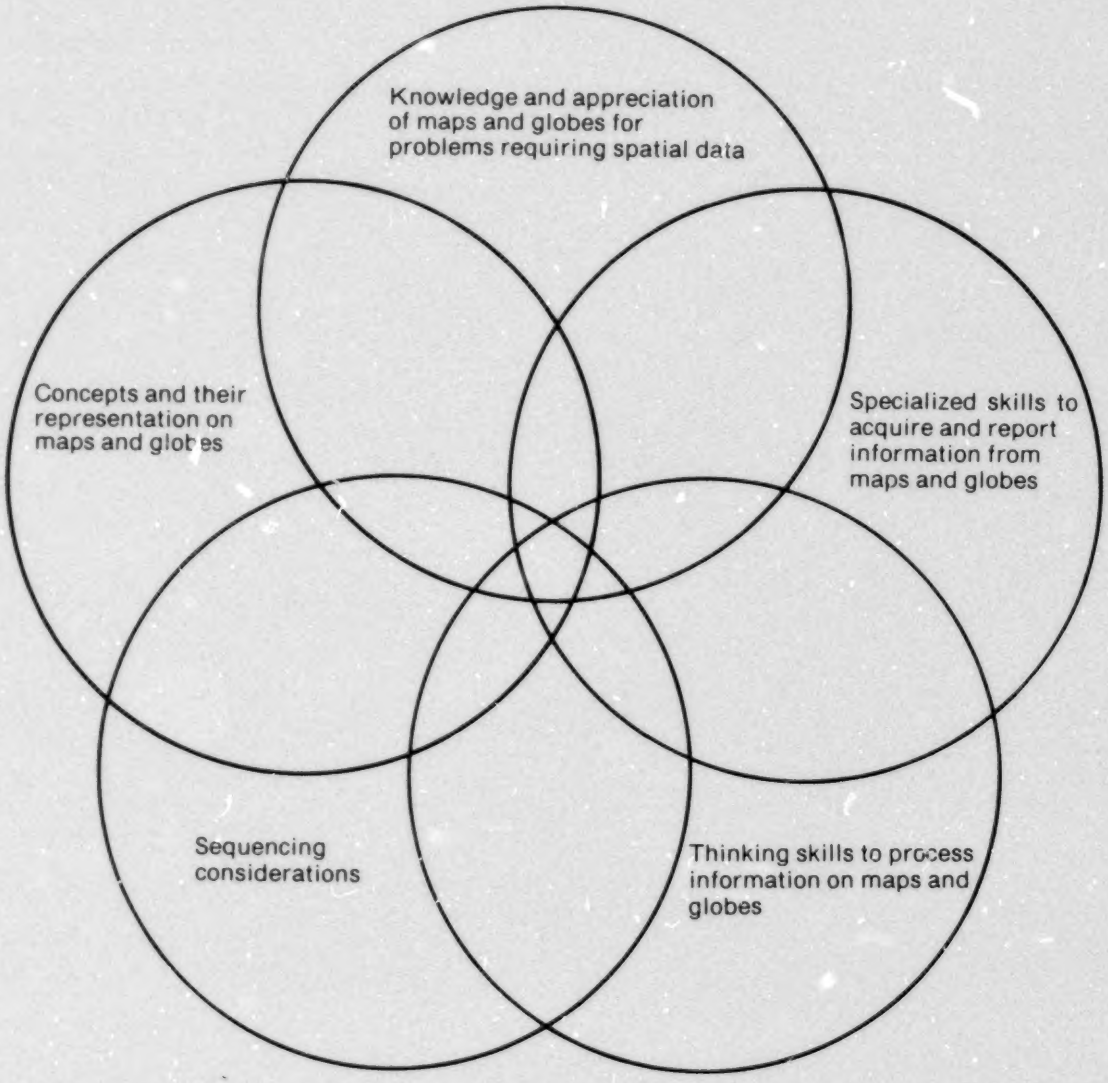
Knowledge and appreciation of maps and globes for problems requiring spatial data
Concepts and their representation on maps and globes
Specialized skills to acquire and report information from maps and globes
Sequencing considerations
Thinking skills to process information on maps and globes

Figure 1: Considerations for an Elementary Map and Globe Skills Program

means to devote kindergarten through eighth grade attention to this subject area should be explored. Use of maps and globes also enriches other curriculum areas such as reading, math, natural science, and art. When map and globe skills instruction is presented in the context of other learning, as opposed to isolated map and globe skills lessons, we communicate that ability to use maps and globes is not an end in itself, but rather a means to an end--tools to learn, to solve problems or make decisions when one's purpose requires spatial information. Leading our students to see this for themselves makes learning to use the media worth doing.

(2) Students must have opportunities to evaluate maps and globes as alternative sources of information. This means providing appropriate tasks and time for students to speculate about the relative value of a range of media including maps and globes. Students must then pursue the selected sources and test their value in a particular context.

Time spent in this manner as part of an already-crowded educational program is justified by the transferable value of these experiences in solving problems, academic or otherwise. Enlightened decision-making depends initially on the ability to select and seek information from a variety of sources. The relative value of maps and globes, as opposed to or along with narrative passages, tables, graphs, dictionaries and television specials can be seen only with repeated experiences in testing their utility. The Guide contains suggestions for providing these

experiences.

2. Effective use of maps and globes depends on specialized skills in acquiring and reporting information.

The term skill refers to the ability to do something well. Thus students who acquire map and globe skills are able to use these media with competence. Competence depends on several factors:

1. the ability to perform specialized operations needed to acquire/report information with use of maps and globes;
2. understanding of particular concepts and their representation on maps and globes;
3. the ability to process or think about information presented on maps and globes.

For purposes here, the specialized operations referred to in (1) above, are discussed separately from other factors. In reality, however, the factors operate in an interdependent and complementary manner. While point (1) focuses on skills merely to extract or report information, meaningful use of maps and globes requires support related to points (2) and (3). The latter considerations are treated later in this paper to allow detailed discussion.

The specialized skills that must be developed in order to acquire and report information from maps and globes are:

1. using symbols - Skilled behavior in this area involves understanding the representational relationship between symbols on maps and globes and their real counterparts. A symbol is any label, line, color, geometric shape, shading or other means used on a map or globe to represent real phenomena. Children who can decode symbols on maps develop the habit of referring to the map legend (or key) and eventually master standardized symbols (rivers, political boundaries) shown on maps or globes without legends. Students who effectively make maps, represent realities with clear and comprehensible symbols and provide legends to communicate their meanings.
2. finding location - Skilled behavior in this area involves determining a position in relation to a reference system when making or reading maps. Reference systems include use of information to fix and describe the location of one object or place relative to another (e.g. The map shows Mary's desk in the back of the room; Calcutta is at the mouth of the Ganges River; Brazil is on the continent of South America). Reference systems also include use of grids to determine location (as in road maps or systems of parallels and meridians to find latitude and longitude).
3. finding directions - Skilled behavior in this area involves orientation (of self or a map) and the ability to use directional terms with understanding relative to self, objects or places, and earth. Directional terms include references such as under or over, to the left/right of, as well as cardinal and intermediate directions. Children who extract directional information from maps cultivate the habit of referring to the direction indicator, eventually master compass directions used when no indicator is shown, and actually or mentally orient the map toward real directions on earth. In map-making, children orient the map to represent accurate directional relationships and provide an indicator to communicate these relationships.
4. using scale and finding distances - Skilled behavior in this area involves ability to use a scale to estimate, find or show real distances between points on earth and sizes of actual areas. Related are measurement skills, understanding of miniaturization and proportion, ability to decode different scale referents commonly used on maps and globes, and ability to draw a map to a given scale.

There is considerable overlap in these categories. One cannot use a map to locate a place, describe the direction of a highway, or use scale to find distance between two points, without using symbols; one cannot use latitude and longitude to determine location without using cardinal directions. These are only a few examples which demonstrate the complementarity in the categories. Separate attention to developing each specialized skill is recommended in the Guide, to offer a program in which all components are systematically introduced, practiced, and refined.

A second point of emphasis is that development of the specialized operations should incorporate map-making as well as the process of acquiring information from maps and globes. Activities related to map-making skills subsume a range of experiences from arranging blocks to model positions of playground equipment, to drawing a simple pictorial map, to plotting data on a prepared map, to drawing a map to scale. Map-making activities are emphasized for two reasons: (1) there are occasions when the best means to communicate information is with use of a map. Thus students should develop the capacity to present information with this medium just as they learn to write letters or prepare tables, diagrams or charts; (2) map-making and map-reading experiences reinforce each other just as learning to write a word helps to read the word. Accordingly, whenever possible, if map-making and map-reading experiences are presented in tandem one will reinforce development of the other. Based on these reasons, suggestions for map-making experiences are provided in the Guide.

3. Effective use of maps and globes depends on supportive concept development.

Skills necessary to acquire and report information are necessary, but not sufficient for meaning-

ful use of maps and globes. Full understanding and productive work also depend on concept development to help students comprehend the realities represented in the media.

### Developing a General Inventory of Concepts

Think about maps found in most texts beginning with the middle grades. Maps may symbolize higher order concepts such as climate, natural vegetation and landforms, as well as their related sub-concepts (hot, cold, warm, cool, rainy, dry, seasons; forests, deserts, prairies; mountains, plateaus, hills, plains, rivers, oceans, seas, lakes, bays, etc.). One would also expect to see an array of high order concepts on maps representing human-related phenomena (population, urban areas, political boundaries, settlements, languages, religions, and so on).

Many concepts in the lists above are developed within the geographic component of a social studies program. Instructional time spent on this subject area enhances children's reading vocabularies and comprehensive skills; instructional time spent to develop a vast concept inventory is crucial to children's abilities to use maps and globes.

We know that children come to school with a limited number of concepts. Growth of this inventory is encouraged through exploration and interaction with concrete phenomena in observable environments. These experiences require strategies, whenever practical, that help children to observe relevant characteristics of landscape features and concrete examples of more abstract phenomena (e.g., space, density, patterns of movement). Any direct experience with which a child can relate will augment understanding of mapped concepts.

While direct observations are particularly suitable for young children, they are not always practical, nor do they always represent the most effective type of experience to develop every concept. In some cases, aerial photographs, particularly those taken at low altitudes and oblique angles, can provide appropriate illustrations of a given concept. For example, a system of expressways, arrangements of streets and intersections, or evidence of high density throughout a central business district cannot be observed directly because of the scale of the phenomena. In these cases, aerial photos with clearly observable details replace direct observation in helping children to perceive the reality.

Learning experiences with aerial photos also provide children with the overhead perspective used in maps. There are obvious benefits to youngsters' using this perspective with photographs that incorporate realistic and familiar images to help them understand the less realistic and strange symbols shown on maps.

Three-dimensional models are also valuable tools to reinforce and develop selected concepts in a relatively concrete manner (e.g., the patterns of buildings along a street; the characteristics of earth as modeled in a globe). Additionally, toy play or sandbox and clay models constructed on the floor by children, reinforce the overhead perspective of maps in a concrete manner.

There are other times when front view photographs, drawings, written and oral explanations or maps themselves (as in the cases of concepts such as region, or international boundary, or global trade) serve as appropriate media to develop or refine concept understanding. Using a combination of strategies which take into account student maturity and interests will help them to understand concepts represented on maps and globes.

### Developing an Inventory of Spatial Concepts

Map and globe symbols are like all other symbols in that they stand for real things. They are different, however, because they additionally represent basic concepts that are spatial in nature: location, direction, distance and scale. The basic concepts are integrated as mature learners use maps and globes to perform location analyses, and to investigate other complex and dynamic aspects of geography such as spatial distributions and relationships among natural and socio-cultural phenomena, areal similarities and differences and direction/volume of flow. To use maps and globes which provide information on these complex aspects of geography, students must be able to apply the basic spatial concepts with understanding.

#### Location

There are several types of learning experiences to help students develop concepts associated with location. In the early school years, children benefit from exploring and describing their own locations and those of physical objects in familiar space. These direct observations are reinforced as children construct three-dimensional models and draw and read simple maps to illustrate the location of objects. Whether making direct observations or using media, students learn that location is always described with some sort of a reference system: (a) with reference to self (as in John is next to me, I am in front of Mary, the desk is to the left/right of me); (b) with reference to a familiar object or environment (as in the plant is next to the goldfish bowl, Lauren's home is behind Paul's); (c) with reference to an abstract or distant environmental feature (as in on the coast, outside the county, adjacent to the city, within the tropics); (d) with reference to a grid system (as in concrete observable grids like rows of seats in a classroom, intersecting community streets, or more abstract number/letter grids on road maps or use of

latitude and longitude); (e) with reference to a global system of directions (school is east of my house, France is northwest of Egypt, surface water supply is depleted more than sixty-five percent each year in the southwest section of the U.S.).

Cardinal and Intermediate Directions

There are also multiple experiences to help develop concepts related to direction. Examples of concrete experiences include facing or pointing to specified vertical and horizontal directions (up, down, front, back, left and right sides of the room). Later experiences would utilize cardinal and intermediate directions to find and follow paths from one object or place to another.

Children's real-world concept of cardinal directions can be developed with reference to the sun and then with reference to points on globes (north and south poles, the equator and the Prime Meridian). When directions have meaning to older students in terms of their own life space, then they can be used with meaning on globes and maps to analyze such things as the directional trend of weather systems, trade or migration routes, or diffusion of a folk song or disease.

Distance and Scale

The ability to understand physical separation between two points or to grasp the size of an area represented on a map or globe depends on children's measurement skills, their understanding of proportion or scale, and on their ability to develop familiar frames of reference.

As in other categories of concept development, very young children benefit from concrete experiences with size and distance. Such experiences begin with use of descriptors for relative size (smaller, bigger) of familiar objects and relative distance (near, far, longest, shortest) between objects in familiar spaces. These experiences should focus on the directly observable environment, on three-dimensional models, simple aerial photos, and, later, on simple maps.

The concept of scale or proportion itself must be comprehended if children are to understand mapped distance as proportional representations of reality. The young child's observation of toy cars and trucks, dolls, doll furniture and houses can be used to elicit verbal descriptions of similarities and differences between the miniature object and its real counterpart. A youngster's sketch and clay model of familiar environments are also early experiences with miniaturization which provide qualitative introductions to the concept of scale.

As children develop math-related skills to measure real distances and size, they begin to cultivate familiar frames of reference (e.g., meters, kilometers, miles). Familiar and concrete images of observable distances help to translate great distances expressed in scale referents on maps and globes. For example, using scale to report that one inch represents one thousand miles is meaningless if one is not familiar with real-world distance covered by one or more miles in the observable environment.

Through a combination of these ideas students are prepared in later years for map use to investigate factors related to the size and shape of cities or countries, the area over which a technological innovation spreads in a given period, or to propose a new plan for community land use by drawing a map to scale.

While more will be said later regarding children's development and sequencing considerations, it is emphasized here that the best map and globe skills instruction we can offer young children is that which develops the concepts they will later process on maps and globes. Thus concept development strategies are incorporated in the Guide to Map and Globe Skills Development.

4. Effective use of maps and globes depends on information-processing or thinking skills.

In addition to having specialized skills and related concepts needed to extract and report information from maps and globes, children should be able to process (think about) data to serve some productive purpose. Processing information from maps and globes provides meaning to the experience, helps to solve problems or make decisions, and encourages new insights. Consider the following example.

Suppose a group of children was seeking the best place for a class field trip to observe the sale of goods and services in the community. After entertaining several interesting suggestions, the children decide a map would be useful to investigate the location of recommended places, distances of these places from school, and routes to follow. The children's decision to use a map implies a need to evaluate each suggestion in terms of its location, distance, and accessibility. In order to perform the evaluation, the children must select an appropriate map, decode symbols to locate each place, use the scale to calculate distances, and use cardinal and intermediate directions to describe routes. In this first set of steps, children are merely extracting information from the map. The steps are necessary, however, before comparing location, distances and routes, and finally evaluating the relative merits of each place for the field trip. The second set of steps involves processing or thinking about the mapped information to serve a particular purpose--using the map to solve a problem. Thus, skilled behavior in comparing, evaluating and other thinking processes works in combination with skills to use symbols, locate places and determine distance and direction.

Thinking about information presented in maps provides rich opportunities for learning. Most social studies textbooks as well as many news-

papers, magazines and television news broadcasts incorporate maps in their presentations. Maps are also included in stories as a means to enlighten the reader. The utility of any map will be realized fully, however, when one can draw from it to make inferences, seek relationships, work out problems or perform other useful processes inherent in human thought. An effective map and globe skills program, therefore, must integrate information-processing skills with skills in acquiring information from maps and globes.

Map-making skills also work in concert with thinking skills. Map-makers of many ages consider the purpose of a map, the best (clearest, easiest to read) symbols to use, appropriate scale, amount of detail to include, and orientation of a map to report information. Thus, the final product gives us a map that communicates location, direction, distance and landscape features as the outcome of reflective thought.

Social studies literature is full of discussions about thinking skills, and a detailed typology and treatment of these skills are beyond the purposes here. It is worth emphasis, however, to note that instructional experiences which develop thinking skills in social studies or other curriculum areas support the development of skills needed to use maps and globes effectively. Reciprocally, use of maps and globes from which children make inferences, comparisons, develop or analyze categories, formulate and test hypothesis, or evaluate data can, indeed, reinforce development of thinking skills. Accordingly, these skills are build into the Guide to Map and Globe Skills Development.

5. The sequence of activities in an effective map and globe skills program incorporates development considerations and opportunities to apply and refine concepts and skills.

The following fundamental points were used to decide when and how to introduce and refine concepts and skill-related behaviors in the Guide:

1. intellectual development (including the child's age and past experiences);
2. the student's need to learn a particular concept or skill, based on
   a. personal significance
   b. demands related to subject matter commonly taught at a given grade level;
3. the availability of continuing opportunities to use a new concept and practice a new skill in the context of subject matter as it is customarily taught at a given grade level.

Research on children's intellectual development suggests that before they begin school, youngsters develop concepts and relationships largely through active expeience and manipulation of objects in their environments. They also use language and thus can perform intellectual processes involving words and sentences to symbolize a limited number of ideas, objects and environments. Alterations in the pre-school child's ideas about the world occur through trial and error activity rather than complex thought. The young child's world view is highly self-centered (the sun rises and sets as he or she awakens and retires; positions of objects are seen in relation to self); the pre-school child encounters difficulty in mentally reversing quantities and lengths (if the shape of an object is changed before the child's eyes, he or she cannot grasp the idea that it can be changed back to its original shape; a strip of paper cut into segments and spread on a table is not seen as equivalent to its original length).

Primary school children retain many of the limitations described above and may experience difficulties in perceiving objects or environments from the viewpoint of others. Additionally, children at this level of intellectual development find it difficult to perceive the perspectives and relationships represented on a map.

Rather than active and overt trial and error as a means to learn about the world or solve problems, children during the primary school years become capable of performing these operations intellectually. They can manipulate symbols of objects and relationships so that they fit into an internalized structure. Children of this age are limited, however, to intellectual manipulation of things they encounter directly or have encountered in the past. Accordingly, it is possible for children to grasp a complex concept at this level provided its attributes are translated into observable or familiar frames of reference. Teachers who help primary school children build concepts through concrete activities that have personal significance enhance the prospects for success with later formalized instruction and more complex learning.

Based on these considerations, primary level learning experiences in the Guide have the characteristics that follow. Instructional experiences involve concrete activity and are geared to the interests of the child. Complex spatial concepts are introduced in the context of observable or familiar frames of reference. Emphasis is on real world observations to expand a child's concept inventory. Media utilized include uncluttered three-dimensional models, large scale aerial photographs, maps with pictorial, semi-pictorial, and increasingly abstract symbols. Learning tasks are brief, focus on familiar environments and incorporate a small number of ideas.

It is worth emphasizing that experiences of the type described above provide a basic foundation for developing map and globe skills. If a broader curriculum decision leads to postponement of map skills instruction until after the primary grades, basic, introductory experiences will still be required.

Beyond the primary grades we know that children's development continues gradually and unevenly until they are capable of more formal thinking during the middle and later elementary school years. Intellectual development can be

augmented by systematic experience. In the case of map and globe skills instruction, this means repeated opportunities to apply and refine learning in new and increasingly complex ways. Complexity increases as the following occur: (1) concepts processed become more abstract; (2) media used contain an increasing number of details, more abstract symbols and represent phenomena which are distant and/or unfamiliar; (3) the tasks students perform increase in complexity so that there are more things to do with data and increasingly difficult intellectual operations are required to process information.

Based on an overall analysis of children's intellectual development, math-related learning, as well as the nature and complexity of particular map and globe related instruction, the Guide developed for this project represents some departures from customary sequencing practices. It is assumed that young children benefit most from basic, concrete instruction as well as simple media experiences with spatial concepts. There seems to be no real need for children to wrestle with extremely complex applications of concepts, tasks or media that require mature perspectives and numerical techniques before they build the appropriate background. Accordingly, the Guide recommends that cardinal and intermediate directions, the use of scale to measure distances and use of latitude and longitude be introduced later than they appear in most curriculum materials published to date.

# K-8 GUIDE*

*The author acknowledges many ideas for this guide drawn from publications listed in the References section. Also acknowledged is assistance from Judith Bock, who provided ideas on using aerial photographs.

## USING THE GUIDE

Recommendations in the Guide are categorized as follows: using symbols, finding location, orienting and using directions, using scale and finding distance. Each category includes recommendations for developing supportive concepts as well as building skills to acquire, process, and report information with use of maps and globes. Additionally, there are instructional ideas to offer practice in evaluating the utility of maps and globes compared to other media. Recommendations in each category are offered as general statements, and, in parentheses, illustrative examples of learning experiences are provided.

Recommendations are presented for each of the grade levels K-8. Grade level assignments should be regarded, however, with extreme flexibility. If ideas seem too sophisticated or too simple for students, suggestions drawn from an earlier or later grade level should be used. Another way to use the Guide would be to aim for development of a set of skills over a range of grade levels (e.g., primary, intermediate and upper level skills). There is no perfect formula to assign a specific level of learning to a particular subject area or point in a child's academic life. The teacher, as the ultimate curriculum developer, must reconcile appropriate instructional strategies with students' needs and intellectual capacities as well as broad curriculum goals. It is in this spirit that recommendations are presented in the Guide to Map and Globe Skills Development.

## KINDERGARTEN

### USING SYMBOLS

CONCEPT DEVELOPMENT

Compares similarities/differences between objects that are real and those shown in models, photos and drawings (makes statements about ways a real car, a toy car, a photo and a sketch of a car are similar and different)

Decodes familiar symbols from pictures (describes the messages communicated from pictures of a stop sign, a red light, a happy face)

SKILLS TO ACQUIRE INFORMATION

Describes characteristics of three-dimensional models from multiple perspectives (tells what is seen in a view of a doll house from the front, back, side and from above)

Identifies selected features on an oblique aerial photo (points to houses, trees, roads, churches, lakes and other features and names the examples)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Makes inferences from photos or sketches and compares these to real environments (viewing pictures of a school library, classrooms, the gym, cafeteria, and nurse's or principal's offices, offers reasons why such rooms are needed and describes similarities and differences between the pictures and rooms in their own schools)

SKILLS TO REPORT INFORMATION

Constructs three-dimensional models on floor of classroom (uses blocks, toy cars and trucks to model a familiar scene)

Models and explains attributes of an imaginary landscape (uses toys and a sandbox to design a scene, tells classmates about the scene and modeled objects)

### FINDING LOCATION

CONCEPT DEVELOPMENT

Describes position of self relative to other persons or objects in the classroom (makes statements describing his/her location as next to Jack, under the light, in the middle of a circle)

Uses pictures to describe relative location of objects (makes statements about positions of objects shown in magazine or textbook pictures using words such as over, under, next to)

SKILLS TO ACQUIRE INFORMATION

Uses a three-dimensional model to describe positions of objects relative to others (given a model with milk cartons to represent houses, masking tape for streets and twigs in clay bases to represent trees; describes relative positions of objects in the model)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses pictures to evaluate merits of various locations for specific objects (generates criteria and draws pictures to symbolize preferred locations in the classroom for a new toy, plant, book or pet)

## ORIENTING AND FINDING DIRECTIONS

### SKILLS TO REPORT INFORMATION

Makes a three-dimensional model to position objects according to instructions (arranges blocks one behind the other to represent a train; places blocks and toys to represent a car next to a house, a store next to a gas station; uses clay to model a ball on a table, a boat under a bridge)

### CONCEPT DEVELOPMENT

Orients self toward positions in the classroom (plays a game responding to instructions such as, "Face the front/back of the room; point up/down; take two steps toward me/away from me.")

### SKILLS TO ACQUIRE INFORMATION

Describes directions on a model or photo of the classroom (points out directions such as up/down on a model or photo)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Classifies pictures of objects according to the directions in which they move (given pictures of objects such as elevators, birds, airplanes, trains, cars, people, swings, typewriters, classifies things that move up/down, side to side and forward/back)

### SKILLS TO REPORT INFORMATION

Draws pictures representing objects moving in given directions (follows instructions to make simple sketches of a boy tossing a ball up in the air, a squirrel climbing down a tree)

## USING SCALE AND FINDING DISTANCE

### CONCEPT DEVELOPMENT

Estimates distances and relative sizes of objects in familiar environments (estimates the closest/farthest desk from the classroom door and paces distances to verify estimates; looks at two boards to estimate largest/smallest and uses pieces of string to verify estimates)

Describes similarities/differences between real objects and scale models of those objects (makes statements comparing relative size of attributes of a real baby, car, or truck and a doll, toy car and toy truck)

### SKILLS TO ACQUIRE INFORMATION

Describes relative distances and sizes on a three-dimensional model (makes comparative statements to indicate that modeled objects are smaller/larger, shorter/taller, nearer/farther than other objects)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Evaluates spaces in terms of appropriateness for selected activities (given pictures of various spaces in school, selects those appropriate for a small reading group, a kickball game, a painted mural, a caramel apple sale)

SKILLS TO REPORT INFORMATION

Makes three-dimensional models (uses blocks to model buildings or other objects and talks about similarities/differences between real and modeled objects)

Compares advantages/disadvantages of media for a given purpose (cites occasions when a photo of a car, a toy car and a sketch of a car might be useful)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Describes similarities/differences between modeled and then mapped objects and realities they represent (tells ways in which the real classroom, a model of the classroom and a tagboard floor map of the classroom are similar and different)

Learns that a globe is a model of earth (uses a satellite photo of earth and a globe to tell ways in which they two are similar/different)

### SKILLS TO ACQUIRE INFORMATION

Describes objects represented in a simple pictorial map (uses the title and key on a pictorial map of the playground to tell about the objects shown)

Describes objects shown in a large scale, vertical aerial photograph (names and points to recognized features; describes ways in which real objects and the photo of the objects are similar/different; counts specific features shown on an aerial photo such as number of houses)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses simple pictorial maps to make generalizations about ways school space is used to meet children's needs (given simple, pictorial maps showing floor plans in three schools, child generalizes that schools provide classrooms, offices, spaces for play, and special purpose rooms; identifies needs met through the use of space in these ways)

### SKILLS TO REPORT INFORMATION

Makes three-dimensional models of familiar environments (makes a clay model of the playground; describes modeled objects)

Makes up symbols to sketch a simple map (invents and sketches symbols to represent equipment on the school playground; provides a legend and map title)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Describes position of self and objects relative to others in the classroom (makes statements describing the location of an object to the left/right, in front of/behind; views other children's positions and makes statements about locations of objects to their left/right and in front of/behind them)

Describes relative locations of objects in a picture (tells what is to the left/right of the dog in the picture; in front of/behind the cat in the picture)

### SKILLS TO ACQUIRE INFORMATION

Describes the location of objects in three-dimensional models (uses objects made of clay to describe their relative positions in terms of left/right, in front/behind, from the child's perspective and from the perspective of a clay figure in the model)

Describes location of objects on a large scale vertical aerial photo and simple map of the same area (describes positions of selected features in relation to others using references such as across the street from, to the left/right of)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses a map to evaluate various locations to serve a given purpose (uses a map of the area surrounding school to weight advantages/disadvantages of several locations for a lemonade stand)

SKILLS TO REPORT INFORMATION

Makes tagboard floor maps to show positions of objects in familiar environments (uses a model of the playground to place two-dimensional symbols on a tagboard floor map)

## ORIENTING AND FINDING DIRECTIONS

CONCEPT DEVELOPMENT

Orients self toward prescribed directions (plays a game by following instructions to "Face the left/right side of the room; line up to the left/right of the teacher; describe an object that is in front of/behind a classmate")

SKILLS TO ACQUIRE INFORMATION

Describes vertical directions on a globe (shows up as away from the globe and down as toward the globe)

Orients a prepared map toward prescribed directions and describes perspectives from various orientations (given a prepared map of the classroom; aligns the map with reality and identifies objects one would encounter walking from Mike's desk toward the window, from Gloria's desk toward the door)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses a simple pictorial map of the school grounds and surrounding streets to evaluate multiple routes (uses a map to evaluate routes to several school exits in the event of a fire drill)

SKILLS TO REPORT INFORMATION

Enters data on simple pictorial maps (using a prepared map of nearby street, shows a car driving toward Front Street, a truck driving toward Main Street, a bus parked in the lot next to the school)

## USING SCALE AND FINDING DISTANCE

CONCEPT DEVELOPMENT

Observes that familiar spaces have length and width that can be measured (paces off and expresses distances between two points in the classroom)

Uses string or measuring tape to measure and compare distances (measures and compares distances from one's own classroom door to the door of an adjacent room and a door more distant)

SKILLS TO ACQUIRE INFORMATION

Uses a simple map of an observed environment to compare mapped distances and sizes with realities (using a map of the school, makes statements about relative sizes of rooms and relative distances between points; uses direct observation to compare the representations with the real spaces)

Uses an aerial photo to describe distance between selected features (counts blocks or numbers of houses between selected features)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Makes qualitative judgments regarding the utility of two maps drawn to different scales (given a prepared map of the classroom, a map showing the school building and another showing the entire school grounds, makes statements about which map would be useful to see where pets live in our classroom, how to go from our room to the nurse's office, to name the streets that surround the school, to see where the playground is located)

SKILLS TO REPORT INFORMATION

Represents relative distances and sizes and compares these to reality (makes a floor model of an imaginary town using blocks of different sizes; qualitatively describes relative sizes of building shown and distances represented)

Draws a simple map to represent relative distance and size (uses the model above to draw a simple map; compares relative sizes and distances represented on the map to those on the model)

SELECTING MEDIA

Compares advantages/disadvantages of media for different purposes (given the problem of helping an out-of-town relative to learn about objects on the school playground, children evaluate merits of a tape recording, a photograph, a chart showing number of swings, slides, etc., and a simple map to communicate the information)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Compares at least two maps of the same area and notes similarities/differences in ways information can be symbolized (given a pictorial map and another using color and geometric symbols to show objects in a community, points out objects on both maps and states ways in which symbols are similar and different)

Recognizes standard symbols commonly used to show cities, rivers, railroads, and highways (points out examples of commonly used symbols on several prepared maps)

Refers to title and legend to decode maps and supplies these when drawing maps (practices these behaviors whenever using a map)

### SKILLS TO ACQUIRE INFORMATION

Identifies major land masses and water bodies on a globe and world map (uses color to discriminate water from land masses; reads labels to name major water bodies and land masses)

Describes landscape features in a community using a semi-pictorial map (uses the key and mapped symbols to name objects in a community)

Identifies features on a low-angle aerial photograph (points to and describes shopping centers, cemeteries, parks, industrial areas)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Prepares maps to help classmates solve given problems (given an outline map of the school building, invents and enters symbols for rooms in the school to be used by new students; completed maps have a title and key)

Uses an aerial photo to categorize features (lists features shown on an aerial photo; categorizes those that are natural and those made by people)

### SKILLS TO REPORT INFORMATION

Invents symbols and draws simple pictorial maps with a title and legend (after a walking trip around the block, invents symbols to show objects seen and maps those providing a title and legend)

Draws a map of an imaginary community incorporating given symbols (draws a map of an imaginary community using symbols selected to show houses, stores, schools, churches, and other places and objects in the community; adds a title and legend)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Uses a grid to describe the location of an object (plays Human Bingo using rows of desks numbered in one direction and lettered in another; uses a prepared grid to describe the location of drawn objects and makes statements such as the house is in A2, the flag is in B4)

### SKILLS TO ACQUIRE INFORMATION

Describes the location of landscape features relative to each other (makes statements such as there are four houses on Front Street, there is a river next to the park, the highway crosses over the river)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to test hypotheses (given the hypothesis that communities provide services to help people learn and to protect them, uses community maps to locate schools, medical offices, hospitals, police and fire stations)

SKILLS TO REPORT INFORMATION

Draws maps of an imaginary community locating services that help meet people's needs (shows location of services in an imaginary community to help people learn, protect them, provide food, water and places of beauty)

## ORIENTING AND FINDING DIRECTIONS

CONCEPT DEVELOPMENT

Distinguishes up/down directions on an aerial photograph (uses a simple, low-altitude photo taken from directly above to make statements that up is away from the photo and down is toward the photo)

SKILLS TO ACQUIRE INFORMATION

Uses a map to describe a route (uses a simple subway map to list the stations passed when riding from one point to another)

Uses the globe to describe a route (plans an imaginary trip around earth at the equator and uses labels to describe major land and water bodies; repeats the process by selecting other routes to travel around the world)

SKILLS TO REPORT INFORMATION (THINKING SKILLS)

Draws maps to describe routes from school to nearby places (draws a map showing route from the child's school to home or other nearby places and exchanges with classmates to see if maps can be read with ease)

## USING SCALE AND FINDING DISTANCE

CONCEPT DEVELOPMENT

Develops measurement skills (estimates, measures, and names the measurement of common objects using linear measures of inch, foot, yard, centimeter and meter)

SKILLS TO ACQUIRE INFORMATION

Uses low-angle aerial photos to make qualitative judgments about relative sizes of objects and linear distances (uses an aerial photo to make statements about places and objects that are larger/smaller, nearer/farther than others)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Evaluates multiple routes to select the shortest distance between two points (given a map of a neighborhood showing a child's home and three grocery stores, decides which store is closest to the child's home; describes what would be seen along the route)

SELECTING MEDIA

SKILLS TO REPORT INFORMATION

Sketches a simple map from an aerial photograph (uses a low altitude, vertical photo to sketch a "bird's eye view" of buildings on a street; reflects relative size of buildings qualitatively)

Compares advantages/disadvantages of media for different purposes (given several maps which symbolize different features in the same commercial area, chooses the map(s) useful to firefighters, crossing guards, people who deliver fresh vegetables and family members looking for medical care)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Describes phenomena represented on maps with standardized symbols (points out symbols for land, water, cities, state and national boundaries, highways, railroads)

Points out natural and human-made divisions on maps and globes (identifies continents and distinguishes them from countries, states, cities, capitals and other human-made divisions)

### SKILLS TO ACQUIRE INFORMATION

Interprets dots, lines and colors symbolizing real phenomena (uses map title, key and dots of graduated sizes to report the number of people who live in given cities; uses color symbols to report ways in which land in a community is used)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to formulate hypotheses (uses simple state and national maps showing natural resources or goods produced to cite some ways communities in a country depend on each other)

Uses maps to make inferences (locates a nearby river on a map, names other rivers that flow in to it, and lists ways in which the community might depend on the river to meet people's needs)

### SKILLS TO REPORT INFORMATION

Enters data on a prepared map of the world (makes symbols for objects found in one's house that come from other countries; places each symbol within the country where the object was made)

Uses an aerial photo of a community to draw a simple map (given an aerial photo of a neighborhood, selects details, invents symbols, sketches a map and provides a title and legend)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Uses number/letter grids to show location (given a prepared number/letter grid overlaying a simple community map, supplies coordinates to locate a list of places on the map)

Uses aerial photos to observe grid patterns made by intersecting streets (traces the street patterns shown on aerial photos)

Uses cardinal directions to describe the relative location of nearby places (makes statements such as "My home is west of school.")

### SKILLS TO ACQUIRE INFORMATION

Uses globes and maps to describe relative location (points to and names continents, countries, states, cities, and names land and water bodies surrounding these places)

Uses maps to locate natural and human-made features within boundaries of continents and countries (lists the continents and countries in which specific features are located)

ORIENTING AND FINDING DIRECTIONS

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Classifies several cities according to their location relative to water bodies or land transportation routes (uses a map of the country to categorize major cities according to their locations adjacent to oceans, rivers, lakes, railroads and major highways)

Uses maps to test hypotheses (given the hypothesis that many world cities developed near water transportation, uses a world map to cite evidence which supports or refutes the hypothesis)

SKILLS TO REPORT INFORMATION

Positions symbols on a number-letter grid (given a grid over a map or aerial photo, a list of symbols for community places and their grid locations, enters symbols in the correct grid cells)

CONCEPT DEVELOPMENT

Orients self to cardinal directions in outdoor setting (uses the sun in its morning and late afternoon positions to learn east and west; points out north and south after mastering east and west; uses a chalk sketch of direction indicator drawn on sidewalk)

Orients self to cardinal directions in the classroom (uses signs posted on classroom wall to show N, S, E, W; plays game to face or point to a given direction as per instructions)

Orients model and then map of the school grounds to cardinal directions (sets up model of school and surroundings using cardboard boxes and orients model with cardinal directions; orients and draws map from the model)

SKILLS TO ACQUIRE INFORMATION

Refers to a direction indicator and uses cardinal directions to follow a prescribed route on a map (finds a hidden treasure using a map and cardinal directions)

Uses cardinal directions on a floor map of the community (refers to the direction indicator and uses a map to describe cardinal directions one would follow to go from the drug store to the grocery store, to the cleaners, to the movie theatre)

Uses cardinal directions on a simple map of the state, the U.S. and the world (orients map with reality and names at least three places south of one's home town, three places west of one's home state, three places east of the U.S., etc.)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to make inferences (given a map of the school, supplies cardinal directions to describe routes one would follow to find a place a) to learn to sing, b) to check out a favorite book, c) to learn another language)

Uses an aerial photograph of the community to evaluate alternative routes (uses photo to evaluate routes a firefighter might take to come to school, routes a bus driver might take to pick up classmates)

USING SCALE AND FINDING DISTANCE

SKILLS TO REPORT INFORMATION

Uses a model to prepare a map oriented to cardinal directions (uses model of school and surrounding area oriented to cardinal directions and draws a properly oriented map; provides a direction indicator)

CONCEPT DEVELOPMENT

Develops measurement skills (uses metric and other standard measures; uses non-standard measures such as "I live three blocks from school.")

Observes relationships between time and distance (records time it takes to walk to various points around the school; measures distance from a given point to another and compares data with observations on time)

Compares sketch of real objects and areas to the realities they represent (observes and sketches a tall tree; measures the height of the sketch and compares measurement to estimated size of real tree)

SKILLS TO ACQUIRE INFORMATION

Estimates time needed to travel varying distances shown on a simple map (uses a map to estimate time it would take to walk to a classmate's home, to the candy store, the park, etc.; verifies estimates by walking to the places selected)

Points out the same area on maps of different scales (finds Mexico on a map of the western hemisphere, a world map and a globe; makes statements about similarities and differences in the representation of Mexico in each case)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Selects from maps of different scales, the one which can provide information needed (given maps of students' home town, home state and country, selects the best to answer the questions such as, "Which map shows that the Atlantic Ocean is east of us? Where our school is located? Names of towns that are east, west, north, or south of our home town?")

SKILLS TO REPORT INFORMATION

Sketches simple maps of familiar neighborhood areas to show qualitative distinctions between relative size and distance (sketches a map to represent buildings or areas that are larger/smaller and distances that are longer/shorter corresponding to the realities; makes statements about relative distances and sizes on the map as reflecting real distances and sizes)

SELECTING MEDIA

Compares advantages/disadvantages of media for different purposes (cites similarities/differences between an aerial photo and a map showing the same area; chooses best medium to answer various questions)

## CONCEPT DEVELOPMENT

Recognizes continents by shape (defines the attributes of continents and labels them on an outline map of the world)

Points out the north and south poles, the equator, tropics of Capricorn and Cancer and the Arctic and Antarctic circles on a globe and world maps (identifies these reference points on a globe and on maps centered on the equator and on each pole)

Defines and points out the northern and southern hemispheres on a globe and world maps (makes statements about the equator as the imaginary line midway between the poles dividing earth into northern and southern hemispheres; points to each hemisphere)

Learns the concept of region (given a world population map, draws circles around areas with dense populations; compares sketch with classmates to see that regions are constructed by mapmakers to show areas with shared characteristics and regional divisions may differ depending on criteria applied as boundaries are drawn; uses a community map to identify a residential region or an industrial region)

## SKILLS TO ACQUIRE INFORMATION

Describes and provides examples of phenomena represented by semi-pictorial symbols, color, dots, lines, shading and labels on a map (uses map title and legend to describe land use in a community, natural resources, major rivers, landforms, climatic characteristics, population density and other phenomena on a local or global scale)

Uses maps to recognize unifying characteristics of regions (describes characteristics which unify various types of regions such as climate, landforms, agriculture, economic activity, etc.)

## SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses symbols on sets of maps to test hypotheses (using a map showing landforms and another showing population density, makes statements about relationships; repeats process with maps of China, Columbia and Java to test the statements)

Uses aerial photographs to compare urban/rural areas (compares housing density, transportation networks and other land use characteristics in urban and rural areas; draws generalizations)

## SKILLS TO REPORT INFORMATION

Invents symbols and maps information (designs an ideal community and draws a map with a legend and title to show ways in which land should be used in the community)

Uses color to map regional differences (given data on agricultural regions in Latin America, uses color to enter data on an outline map of the area showing the regional boundaries)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Uses cardinal and intermediate directions to describe the relative location of places (states that the grocery store is northeast of the drug store, Los Angeles is west of my hometown, when you're in Chicago, Lake Michigan is east of you, when you're in Bombay, Darwin, Australia is southeast of you)

### SKILLS TO ACQUIRE INFORMATION

Uses maps and globes to classify locations in the northern and southern hemispheres (points to a place on a globe and maps and states whether the place is in the northern or southern hemisphere)

Uses cardinal and intermediate directions to describe the relative location of places (uses a map or globe to make statements such as, the Atlantic Ocean is east of New York City, Sri Lanka is southeast of India)

Identifies physical features on aerial photographs and maps (uses photos and maps to point out and describe the relative location of a peninsula, cape, isthmus, delta, island, lake, river tributary, etc.)

### SKILLS TO PROCESS INFORMATION

Uses world maps to make inferences (uses a world climate map to infer relationships between average temperatures and distance from the equator; uses a list of U.S. imports in 1980 to locate places in the world Americans depend on for natural resources and manufactured goods)

### SKILLS TO REPORT INFORMATION

Positions symbols on a number-letter grid (given a map of a state and a list of grid locations for towns in the state, enters symbols in the correct grid cells)

On an outline map of the world, correctly locates and labels selected reference points (uses maps centered on each pole and on the equator to label the poles, equator, tropics and circles)

Correctly positions continents in arrangements centered on each pole and on the equator (using cut-out shapes of the continents, arranges them around the north pole, then the south pole and centered on the equator)

## ORIENTING AND FINDING DIRECTIONS

### CONCEPT DEVELOPMENT

Orients self toward intermediate and cardinal directions (walks toward the north, southeast, northwest according to instructions; uses a chalk sketch on the sidewalk or floor to show cardinal and intermediate directions)

Orients self toward reference points used on a globe (faces the north pole, south pole, equator, the Tropic of Cancer, Tropic of Capricorn, the Arctic Circle, and the Antarctic Circle; shows real life east-west directions represented by parallels designated as the equator, tropics of circles; shows real-life directions one would follow to reach the north and south poles)

SKILLS TO ACQUIRE INFORMATION

Refers to direction indicator and uses directions on a map (orients the map and tells directions one would walk from one place to another using a map of a park, zoo, the community; uses states, national and world maps to tell directions one would follow to go from one place to another)

Uses cardinal and intermediate directions on a road map (orients map correctly and describes an imaginary trip from one city to another, supplying directions one would follow along highways)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to make inferences (uses a U.S. agricultural products map and specifies directions in which these products might be shipped to students' home town; makes inferences about ways we depend on people in other places)

Uses an aerial photo to select and follow a route (establishes objectives for a walking tour of the neighborhood, uses an aerial photo to select and trace the route stating cardinal and intermediate directions to be followed)

SKILLS TO REPORT INFORMATION

Uses a narrative passage to draw a map (given a literary description of an imaginary or real voyage along a route, uses arrows to map the route of the traveler)

Uses a graph to map given information (uses a bar graph showing exports of a commodity to specific countries; draws arrows to show the information on an outline map of the world)

USING SCALE AND FINDING DISTANCE

CONCEPT DEVELOPMENT

Computes distances requiring multiples of familiar frames of reference (says that a trip of 100 kilometers is equivalent to 10 x 10 kilometers)

Compares photographed distances to realities (uses a ruler and a low altitude aerial photo to measure distances from one point to another three blocks away; compares measurement of the photographed distance to a familiar three block distance in the neighborhood)

Understands proportional representation (makes a two-inch sketch of a twenty-foot tree; sketches the front of a building 50 feet wide at a scale where 1":5'; sketches a wall that is 80 meters long at a scale where 1 cm:8 m)

SKILLS TO ACQUIRE INFORMATION

Uses a globe to estimate relative distances between places and sizes of areas (estimates longer/shorter straight line distances from Tokyo to San Francisco, from Tokyo to Bogota and from Tokyo to Moscow; estimates size comparisons between the U.S. and Canada, France and Nigeria, India and Zaire)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Evaluates information that can be gathered from maps drawn at different scales (given maps showing a small community in China, all of China and a world map show-

ing China, makes statements about information that could and could not be obtained from each map)

SKILLS TO REPORT INFORMATION

Uses scale to sketch simple maps (uses a scale of 1":2' to sketch a room 20' wide and 30' long; decides on a scale to sketch a house 40' long and 100' wide)

SELECTING MEDIA

Compares advantages/disadvantages of media for different purposes (decides whether a globe or map is best to compare sizes of water bodies and land areas; decides whether a globe or map is best to compare world population distributions; decides whether a literary treatment or a map is best to find out about a voyager's feelings when sailing across the ocean)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Points out the prime meridian and the meridian labeled 180° (identifies these reference points on a globe, on maps centered on the poles and on other maps)

Points out the eastern and western hemispheres (makes statements indicating that all places east of the Prime Meridian to 180° are in the eastern hemisphere; all places west of the Prime Meridian to 180° are in the western hemisphere)

### SKILLS TO ACQUIRE INFORMATION

Describes phenomena represented on a map (given a world map showing oil production areas, categorizes data by continent, country and by location in the northern, southern, eastern and western hemispheres)

Uses an aerial photograph of the community to cite changes (describes changes which have occurred in the local community based on information shown in an aerial photo taken in the past)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to make inferences (using a map showing coal and iron ore deposits, rivers and cities in England in the 1700s along with a narrative passage about England's sources of wool and cotton in that period, makes statements about the relationships between the country's early industrialization and its geography)

Uses maps to formulate hypotheses (given a world map showing oil, coal and natural gas producing areas and a map showing industrialized/non-industrialized countries, identifies those countries which probably import energy supplies)

### SKILLS TO REPORT INFORMATION

Invents symbols and maps information (takes a census of students in each classroom; selects colors and a system to show number of students per room on an outline map of the school)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Defines and points out global reference points (defines and points to the north and south poles, the equator, the tropics, the circles, the Prime Meridian and the 180° meridian; defines parallels and points to those that are north and south of one's location; defines meridians and points to those that are east and west of one's location)

### SKILLS TO ACQUIRE INFORMATION

Describes relative location of places given multiple reference points (uses cardinal and intermediate directions as well as reference points such as the equator, tropics or other cities to describe the relative locations of world cities)

Uses cardinal and intermediate directions to describe the relative location of landscape features (states that the mouth of the Columbia River is in the northwest part of the U.S.; the mouth of the Amazon River is in northeast Brazil; the Sahara is in north Africa; Bangkok is in Thailand and Thailand is in southeast Asia)

Uses a grid system to locate points on an aerial photograph (uses a number letter system to name coordinates for selected features on aerial photos or maps)

## SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to make location decisions (given a map showing land contours, transportation arteries, land used for residences, businesses, factories and open space areas, generates criteria and proposes sites for a cemetery, a baseball park, a concert hall, and a preserved wetland)

## SKILLS TO REPORT INFORMATION

Uses maps to report information about historical change (uses historical accounts to sketch maps of a place at various historical periods; draws maps to show what a place might be like fifty years in the future)

### ORIENTING AND FINDING DIRECTIONS

## CONCEPT DEVELOPMENT

Demonstrates understanding of parallels and meridians as imaginary east-west and north-south lines respectively (uses a globe to trace the routes of parallels and meridians and describes the direction of movement along one of these imaginary lines)

Demonstrates understanding of great circle routes (defines a great circle and uses string to show a great circle route on a globe)

## SKILLS TO ACQUIRE INFORMATION

Uses cardinal and intermediate directions on maps (uses maps of several scales to describe the direction one would travel from one place to another)

## SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses flow maps to make inferences (uses maps showing migratory routes of people in various historical periods; offers reasons why people might have migrated during a given period and why they followed particular routes)

## SKILLS TO REPORT INFORMATION

Draws maps to provide directions to points in and around one's home town (prepares a map to show a route from school to the ball park or central business district)

### USING SCALE AND FINDING DISTANCE

## CONCEPT DEVELOPMENT

Recognizes a graphic scale referent and understands it communicates that a given number of units on a globe or map represents a given number of units on earth (points to the scale on various maps and uses own words to describe the distances represented)

Expresses distances between areas of familiar places (indicates that an amusement park is three kilometers from the school, the school is one mile from the zoo, that the size of the school playground is one acre)

## SKILLS TO ACQUIRE INFORMATION

Uses scale to compute distances in familiar areas (uses maps or aerial photos showing a local park, zoo, or other local places to compute distances from one point to another; uses maps with scales expressed graphically in metric and Imperial or English systems)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to test hypotheses (given the hypothesis that "our community is linked to the global community," uses a classified phone directory to inventory and map the community's links with places in various countries through its restaurants, car dealers, electronics stores, banks, airlines, gift shops and other categories; uses completed maps as evidence to support or refute the hypothesis)

Evaluates the merits of large and small scale maps to solve problems (given a problem regarding a local land use conflict and several large and small scale maps of the same area, selects the best map to understand the problem)

SKILLS TO REPORT INFORMATION

Uses scale to sketch simple maps (selects an appropriate scale and sketches a house 40' x 100'; measures and constructs a map of a park drawn to scale)

SELECTING MEDIA

Compares advantages/disadvantages of media for different purposes (evaluate the relative merits of a diary to describe an historical village and a map of the village to communicate information about where people lived, worked, played, got their supplies)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Understands that degrees are used to measure circles and thus are units used to measure earth (states that any circle around the globe is 360° ; distance between the equator and either the north or south pole is 90° , between the Prime Meridian and the 180th meridian is 180°)

Compares arrangements of parallels and meridians on globes with arrangements of these lines on maps (points out size and shape distortions of land masses on maps; relates these to arrangements of parallels and meridians on a map compared to a globe)

### SKILLS TO ACQUIRE INFORMATION

Describes phenomena represented on maps (uses three maps showing distribution of forested land in 1850, 1900 and 1950 to describe changes observed)

Describes phenomena represented on cartograms (using a cartogram in which countries with large populations are exaggerated in size and countries with relatively small populations are proportionally reduced in size, makes statements about the number of people in several countries)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to make inferences (given maps showing distribution of forested lands in 1850, 1900 and 1950 and maps showing the growth of urban areas over the same period, suggests some effects of increasing urbanization)

Uses cartograms to make inferences (compares a cartogram showing population by continent and a standard world map showing continents in their actual proportionate sizes; lists countries in which there are probably pressures on local resources bases)

### SKILLS TO REPORT INFORMATION

Invents symbols and maps information (given a map showing population growth by state in the U.S. over twenty years and another showing climate in the U.S., uses color to show on a map, states in which climatic factors and population pressures may create a scarce water supply)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Understands that latitude measures how far a place is north or south of the equator and longitude measures how far a place is east or west of the Prime Meridian (points to the parallel at 30° north of the equator; points to the meridian at 160° E and states that it is at 160° east longitude or 160° east of the Prime Meridian)

### SKILLS TO ACQUIRE INFORMATION

Uses a globe and a world map to provide the approximate latitude and longitude of major cities (gives the approximate latitude and longitude of New York City, Warsaw, Cairo, Quito, New Delhi, and Capetown; categorizes these locations by hemispheres)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to locate and make inferences about characteristics of a place (given the latitude and longitude of a place, locates it on an elevation map, a climate map and a map of natural vegetation to infer characteristics about the natural environment)

SKILLS TO REPORT INFORMATION

Plots points to represent the correct location of cities by latitude and longitude (given an outline map of the world and a list of cities with their coordinates, enters points and labels to show location)

ORIENTING AND FINDING DIRECTIONS

CONCEPT DEVELOPMENT

Uses the globe, maps centered on the poles and maps centered on the equator or other parallels to describe directions from one point to another (traces a route to the north, south, east or west on the globe, on polar maps and on maps centered on a parallel)

SKILLS TO ACQUIRE INFORMATION

Uses cardinal and intermediate directions on a map (uses flow lines on a map of the world shipping routes to make statements about the direction of flow and volume of trade among several countries)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to formulate hypotheses (uses a flow map showing world trade of farm products to suggest consequences of interrupting this flow of trade)

SKILLS TO REPORT INFORMATION

Invents symbols to map information (uses fact sheets describing major migrations to our country; invents symbols to represent the information on an outline map of the world)

USING SCALE AND FINDING DISTANCE

CONCEPT DEVELOPMENT

Understands that 1° of latitude is approximately equal to 70 miles or 110 kilometers (uses parallels on the globe to measure mileage between 10° and 35° N; between 10° and 35° S)

Uses metric and Imperial or English measures to compute area (measures length and width of familiar spaces to compute area)

SKILLS TO ACQUIRE INFORMATION

Uses the scale referent on a city map to compute distances (computes distances between points on designated routes; computes the number of square miles shown on a city map; computes time it would take to travel between two points in a car traveling 30 mph)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Computes distances on a city map and estimates time to travel by various methods at different times of the day (computes distances between places and estimates time

needed to cover the distances on foot, on a bicycle or in a car traveling 20 mph at 8 a.m., 10 a.m., 2 p.m., and 6 p.m.)

Computes distances between places using an aerial photograph (measures distance between two points on an aerial photo; uses a satellite image to compute distances between two cities using notations on a road map; uses aerial photo to point out natural and human made features that lead to differences in the two computations)

SKILLS TO REPORT INFORMATION

Uses scale to sketch a map (given a scale of 1" to 500', sketches a map of an imaginary community showing a court house, supermarket, park, houses and other features drawn to scale specifications)

SELECTING MEDIA

Compares advantages/disadvantages of media for given purposes (given four maps showing Japan's population density, elevation, climate and economic activities, selects the best map(s) to answer given questions)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Understands that isolines are lines on a map which connect points of equal value (states that iso is a Greek prefix meaning equal; uses maps to explain isolines connecting points of equal rainfall, temperature, barometric pressure, elevation, water depth, population, levels of pollution, etc.)

### SKILLS TO ACQUIRE INFORMATION

Describes phenomena represented on a map (uses a topographic map to identify the highest/lowest elevations in an area, the presence of rivers and directions of their flow, presence of houses, schools and other cultural features; uses a map with isolines showing average rainfall in the U.S. to note areas with low, moderate and heavy average rainfall)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to classify data and to make inferences (uses a shaded relief map to classify major physical regions in India; uses a topographic map showing a rural landscape to classify resources of economic value in an area; uses a topographic map to infer effects that landforms have on transportation and building patterns; uses a map with isolines showing levels of pollution to infer presence of heavy auto traffic or industrial activity in areas with high pollution levels)

### SKILLS TO REPORT INFORMATION

Makes three-dimensional models (uses layers of styrofoam, wall board or other materials of uniform thickness cut to the shape of a hill; places one plane upon the other to make a relief model; states that contour interval is the thickness of each plane)

Uses contour lines to map relief in an area (draws a map of an imaginary hill 500′ high using an even contour interval of 100′)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Understands that latitude increases going from the equator toward the poles; longitude increases going east or west from the Prime Meridian toward the 180° meridian (uses a map showing only an area between 25° and 45° north latitude; states that the area is in the northern hemisphere since parallels are numbered 25° , 30° , 35° , 40° , and 45° from south to north)

Understands that a degree of latitude or longitude is divided into 60 minutes and a minute is divided into 60 seconds (uses a large scale map expressing latitude and longitude in degrees, minutes and seconds; states that the place is 5° 29′ 35° north latitude and 30° 40′ east longitude)

### SKILLS TO ACQUIRE INFORMATION

Uses latitude and longitude to locate places (interpolates latitude and longitude of places shown between labeled coordinates; given the latitude and longitude of a city, uses the coordinates to find its location on several different maps, including polar projections)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to make inferences (points out and defines characteristics of low, middle, and high latitude climates; offers reasons for the characteristics relating climatic factors to latitude, earth's tilt on its axis, and revolutions around the sun)

SKILLS TO REPORT INFORMATION

Uses tracing paper to outline specific areas shown on an aerial photo (using an aerial photo of a metropolitan area, identifies and traces outlines of a central business district, suburbs and satellite cities)

## ORIENTING AND FINDING DIRECTIONS

CONCEPT DEVELOPMENT

Uses the globe, maps centered on the poles and maps centered on the equator and other parallels to describe directions from one point to another (traces a route to the north, south, east or west on the globe, on polar maps and on maps centered on a parallel)

SKILLS TO ACQUIRE INFORMATION

Uses cardinal and intermediate directions (given topographic maps of varying scales, describes the directional trend of landforms, rivers and transportation routes)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses maps to formulate hypotheses (selects appropriate maps to suggest reasons for historical routes of explorers; uses a topographic map to relate directional trends of landforms, waterways, residential development and transportation routes; uses a road map and a relief map of the state to suggest reasons for highway patterns)

SKILLS TO REPORT INFORMATION

Constructs a flow map (makes direct observations of the direction and volume of traffic along two intersecting streets; constructs a map to show the data)

## USING SCALE AND FINDING DISTANCE

CONCEPT DEVELOPMENT

Uses maps with scale expressed in various ways (states that 1" represents one mile when referring to a graphic scale, when the scale is expressed as a ration as 1:63,360, or as a fraction such as 1/63,360; converts inches to miles knowing that there are 63,360 inches in one mile; uses metric measurements to perform the same tasks)

SKILLS TO ACQUIRE INFORMATION

Uses a scale referent to compute distances (computes distances between points on a map of the state, country and world)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses scale to evaluate several routes (computes distances from one place to another

along several routes; categorizes the routes according to the distance of each and then according to estimated time it would take to follow each route)

SKILLS TO REPORT INFORMATION

Uses contour lines to map relief in an area (given a profile of a landscape with one hill 200′ high and another to the east, 375′ high, students draw a map of the area to scale)

SELECTING MEDIA

Compares advantages/disadvantages of media for given purposes (given the task of communicating information about world trade in agricultural, mineral and manufactured products, prepares a narrative explanation and a set of maps; compares the advantages/disadvantages of the finished products)

## USING SYMBOLS

### CONCEPT DEVELOPMENT

Understands ways in which information on maps is presented with the use of graphs (uses a map with bar graphs showing the number of factories in several Japanese cities; uses a world map with graduated circle graphs showing composition and volume of agricultural production in selected countries)

### SKILLS TO ACQUIRE INFORMATION

Describes phenomena reported on a map (uses a computer drawn map to make statements about voting patterns in an area; uses a graduated circle map to make statements about the composition and volume of trade in the country relative to the composition and volume of trade in other countries; uses dot maps to make statements about population per square mile in an area in 1930, 1950 and 1980)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Compares historical maps of an area (uses maps of a community in southern California to note changes in land use; cites evidence to support inferences and supplies hypotheses to explain the changes observed)

Uses maps to make inferences (given maps showing climate, landforms, and agriculture in an area, describes and relates the patterns shown; does a detailed study of a region using maps to acquire and interrelate information about the natural and sociocultural environment)

### SKILLS TO REPORT INFORMATION

Uses graphs to plot information on a map (given a set of graduated circle graphs showing per capita energy consumption in selected countries for 1960 and 1980, prepares maps to show the data and makes statements about changes observed)

## FINDING LOCATION

### CONCEPT DEVELOPMENT

Understands relationships between earth's rotation, longitude, time of day (knows earth rotates on its axis a full 360° in a 24 hour period; computes number of degrees rotated in one hour; states that as one moves toward the east, the hour is later and toward the west the hour is earlier; states that when crossing the International Date Line, Sunday becomes Monday when one goes west, and Monday becomes Sunday when one goes east)

### SKILLS TO ACQUIRE INFORMATION

Uses a time zone map to compute time of day at various locations (given the fact that it is 4 p.m. in Chicago, states that it is 5 p.m. in New York, 3 p.m. in Phoenix, and 2 p.m. in Los Angeles; given the fact that it is 6 p.m., Tuesday in Chicago at 90° W, computes the time and day in Vienna, Peking, and London)

### SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses an aerial photograph to evaluate environmental effects on a landscape (uses an aerial photograph of a strip mining or logging operation to describe and evaluate effects on the natural landscape)

Uses maps to locate places and make inferences (given the latitude and longitude of a place, uses maps to relate and report characteristics of its natural and socio-cultural environment as well as its location relative to other places)

Uses maps to formulate hypotheses (given maps showing population, crime rate, and data on employment, health, and education, generates hypotheses about the quality of life in several neighborhoods in a large city)

SKILLS TO REPORT INFORMATION

Invents symbols and maps information (given data on crime rate in a city's neighborhoods, invents symbols and plots the data on a neighborhood map of the city)

## ORIENTING AND FINDING DIRECTIONS

CONCEPT DEVELOPMENT

Uses the globe, maps centered on the poles and on parallels to describe directions from one place to another (traces a route to the north, south, east or west on a globe, polar maps and maps centered on a parallel)

Understands that map-makers may place any direction at the top of the map (cites weaknesses in statements such as, "Australia is the land down under," references to southern California as "lower California," references to Canada as "above" the U.S.)

SKILLS TO ACQUIRE INFORMATION

Uses cardinal and intermediate directions on a map; finds examples of maps with north at the center, top, bottom or sides of the map; uses cardinal and intermediate directions to trace routes on each map)

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses a map to evaluate alternatives for the directional trend of a proposed highway (given a map showing land use in an area, generates criteria and proposes the location and directional trend of a new highway in the area)

Uses aerial photographs and maps to make inferences about travel corridors (makes inferences about reasons for historical routes between places)

## USING SCALE AND FINDING DISTANCE

CONCEPT DEVELOPMENT

Uses maps with graduate circle graphs to show proportional representation (given a set of circle or bar graphs in graduated sizes, showing volume and composition of imports in selected countries, states that the overall size of the graph in relation to other graphs is proportional to the amount of imports represented)

SKILLS TO ACQUIRE INFORMATION

Uses scale to compute distance (uses the globe to compute distances from one place to another along a great circle route; uses a large scale aerial photo with a scale referent to compute approximate size of the area shown in square miles)

SELECTING MEDIA

SKILLS TO PROCESS INFORMATION (THINKING SKILLS)

Uses scale to evaluate routes (uses a globe to evaluate several routes including a great circle route to travel from New Orleans to Tokyo; selects the shortest route between the places)

SKILLS TO REPORT INFORMATION

Selects an appropriate scale to map an area (considers size of an area, size of sheet to be used for map, and size of details to be shown in order to select an appropriate scale and draw a map)

Compares advantages/disadvantages of media for given purposes and chooses media to solve problems such as a) finding the shortest route between one's home town and Hong Kong, b) identifying countries whose boundaries appear to coincide with natural features, c) comparing size and location of the U.S. and China, d) tracing and comparing distances between San Francisco and other California cities, e) selecting and describing a site for a new park in the community, f) investigating litter patterns on a local street)

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